

REMARKS

Applicants request favorable reconsideration and allowance of the subject application in view of the preceding amendments and the following remarks.

Claims 1-12 are presented for consideration. Claims 1 and 11 are independent. Claims 1 and 11 have been amended to clarify features of the subject invention. Support for these changes can be found in the original application, as filed. Accordingly, no new matter has been added.

Applicants requests favorable reconsideration and withdrawal of the objection and rejections set forth in the above-noted Office Action.

Claim 1 was objected to due to an informality. Specifically, the Examiner noted that “bias position” recited in line 6 of this claim should be corrected to conform to the “bias portion” recited in line 4. This change has been made. Accordingly, Applicants submit that this objection has been overcome and should be withdrawn. Such favorable indication is requested.

Turning now to the art rejections, claims 1, 3, 4 and 10-12 were rejected under 35 U.S.C. § 103(a) as being unpatentable over U.S. Patent No. 5,854,490 to Ooaeh et al. in view of U.S. Patent No. 4,467,205 to Beisswenger et al. Claim 2 was rejected under 35 U.S.C. § 103(a) as being unpatentable over the Ooaeh et al. patent in view of the Beisswenger et al. patent as applied to claim 1, and further in view of U.S. Patent No. 4,199,689 to Takigawa. Claims 5 and 6 were rejected under 35 U.S.C. § 103(a) as being unpatentable over the Ooaeh et al. patent in view of the Beisswenger et al. patent as applied to claims 1, 3, 4 and 10-12, and further in view of U.S. Patent No. 5,136,171 to Leung et al. Claims 7-9 were rejected under 35 U.S.C. § 103(a) as being unpatentable over the Ooaeh et al. patent in view of the Beisswenger et al. patent as applied above to claims 1, 3, 4 and 10-12, and further in view of U.S. patent application publication number 2003/0189180 to Hamaguchi et al. Applicants submit that the cited art,

whether taken individually or in combination, does not teach or suggest many features of the present invention, as previously recited in claims 1-12. Therefore, these rejections are respectfully traversed. Nevertheless, Applicants submit that independent claims 1 and 11, for example, as presented, amplify the distinctions between the present invention and the cited art.

In one aspect of the present invention, independent claim 11 recites an electron gun including a cathode portion which emits electrons, an anode portion which has an aperture and accelerates the emission electrons, a bias portion which is arranged between the cathode portion and the anode portion and controls trajectories of the emission electrons so as to form a crossover between the bias portion and the anode portion so that the electrons do not strike the anode portion, and a shielding portion disposed below the anode portion for shielding some of the emission electrons, and having a cooling portion which cools the shielding portion. The cooling portion is disposed at the lower part of the shielding portion. The shielding portion includes a tilt portion tilting with respect to an incident direction of the emission electrons and includes a closing portion located between the tilt portion and the anode portion for inhibiting the electrons reflected by the tilt portion from passing through the aperture of the anode portion.

In another aspect of the present invention, independent claim 11 recites an electron beam exposure apparatus including an electron gun including a cathode portion which emits electrons, an anode portion which has an aperture and accelerates the emission electrons, a bias portion which is arranged between the cathode portion and the anode portion and controls trajectories of the emission electrons so as to form a crossover between the bias portion and the anode portion, so that the electrons do not strike the anode portion, and a shielding portion disposed below the anode portion for shielding some of the emission electrons, and having a cooling portion which cools the shielding portion. The cooling portion is disposed at the lower part of the shielding

portion. The apparatus further includes a stage which moves in holding a substrate to be exposed by using the emission electrons. The shielding portion includes a tilt portion tilting with respect to an incident direction of the emission electrons and includes a closing portion located between the tilt portion and the anode portion for inhibiting the electrons reflected by the tilt portion from passing through the aperture of the anode portion.

Accordingly, in the present invention, the shielding portion is disposed below the anode portion for shielding some of the emission electrons so that the electrons should not strike the anode portion, and the cooling portion is disposed at the lower part of the shielding portion. By this arrangement, the present invention provides an arrangement in which a heat generation portion is put together with the shielding portion, and the cooling portion cools the generated heat, to thereby stabilize the temperature.

Applicants submit that the cited art, whether taken individually or in combination, does not teach or suggest such features of the present invention, as recited in independent claims 1 and 11.

The Ooaeh et al. patent shows a charged particle beam exposure device in which an electron gun emits an electron beam traveling along a beam axis. The electron gun has a cathode having a tip, the tip having substantially a circular conic shape and a tip surface substantially at the beam axis. A first voltage is applied to the cathode. An anode has a first aperture substantially on the beam axis to which a second voltage higher than the first voltage is applied. A control electrode has a second aperture substantially on the beam axis and a voltage lower than the first voltage is applied to the control electrode to control a current of the cathode. The second aperture is larger than the tip surface. A guide electrode having a third aperture substantially on the beam axis is arranged between the cathode and the anode, and a voltage

higher than the first voltage and lower than the second voltage is applied to the guide electrode. The third aperture is smaller than the tip surface. A lens electrode with a fourth aperture substantially on the beam axis is arranged between the guide electrode and the anode. A voltage lower than the first voltage is applied to the lens electrode to form a cross-over image of the electron beam. The fourth aperture is larger than the third aperture.

In more detail, the Ooaeh et al. patent shows a beam-cutting-off aperture (metal electrode) 411 having a cooling mechanism 430 for stabilizing the temperature. The guide electrode 48 of the electron gun 10, as shown in Figure 7 of that patent, may be considered to correspond to the shielding portion of the present invention. Applicants submit, however, that according to the Ooaeh et al. patent, the guide electrode 48 is not cooled. Thereby, the electrode 48 is easily heated. Further, in that patent, the electrons emitted from the cathode are irradiated to the electrodes 48 and 41, and the electrodes are heated. In marked contrast, in the present invention, the bias portion prevents the electrons from striking the anode portion, the shielding portion shields the electrons to thereby concentrate the generated heat, and the cooling portion cools the heat generation portion. Applicants submit that the Ooaeh et al. patent does not teach or suggest such features of the present invention, as recited in independent claims 1 and 11.

Applicants further submit that the remaining art cited does not cure the deficiencies noted above with respect to the Ooaeh et al. patent.

The Beisswenger et al. patent shows a restrictor M (anode electrode) having a tilt portion. The anode electrode may be considered to correspond to the shielding portion of the present invention. In the Beisswenger et al. patent, a high electrical field is impressed to the anode electrode so that scattering electrons and secondary electrons are generated in the high electrical field, which causes weak discharge. Further, the restrictor in that patent is disposed directly

below the cathode K, and is not disposed below the bias portion and the anode portion, in the manner in the present invention recited in independent claims 1 and 11. Applicants submit, therefore, that the Beisswenger et al. patent likewise does not teach or suggest salient features of Applicants' present invention, as recited in independent claims 1 and 11.

The Examiner relies on the Takigawa patent for teaching an electron gun with a highly controllable diameter at a beam cross-over point, which is formed using a cathode (emitter) having a hemispherical (that is, rounded) top surface. The Examiner relies on the Leung et al. patent for teaching that when a cooling portion is used with a Faraday cage (210) to measure the current of an electron beam, it must include an insulator and de-ionized water, which should be passed through the cooling portion. The Examiner relies on the Hamaguchi et al. publication for teaching that a plurality of electron guns can be provided in a single chamber, and that additional electrodes (slit-deflecting unit 15) to which voltages are applied can be provided between the anode and the fielding portions (slit covers 11).

Applicants submit, however, that these remaining citations, as with the Ooaeh et al. patent and the Beisswenger et al. patent, do not teach or suggest salient features of Applicants' present invention, as recited in independent claims 1 and 11, which have been discussed above. Namely, that art, even if combined in the manner suggested in the Office Action, does not teach or suggest the arrangement of the bias portion, the shielding portion, and the cooling portion of the present invention, as recited in those claims. Accordingly, the remaining art cited adds nothing to the teachings of the Ooaeh et al. patent and the Beisswenger et al. patent that would render obvious Applicants' present invention, as recited in independent claims 1 and 11.

For the foregoing reasons, Applicants submit that the present invention, as recited in independent claims 1 and 11, is patentably defined over the cited art, whether that art is taken individually or in combination.

Dependent claims 2-10 and 12 also should be deemed allowable, in their own right, for defining other patentable features of the present invention in addition to those recited in their respective independent claims. Further individual consideration of these dependent claims is requested.

Applicants further submit that this Amendment After Final Rejection places this application in condition for allowance. This Amendment was not earlier presented because Applicants believed that the prior Amendment placed the application in condition for allowance. Accordingly, entry of the instant Amendment, as an earnest attempt to advance prosecution and reduce the number of issues, is requested under 37 CFR 1.116.

Applicants also request favorable reconsideration, withdrawal of the objection and rejections set forth in the above-noted Office Action, and an early notice of allowance.

Applicants' undersigned attorney may be reached in our Washington, D.C. office by telephone at (202) 530-1010. All correspondence should be directed to our address listed below.

Respectfully submitted,

A handwritten signature in black ink, appearing to read "Steven E. Warner", is written over a horizontal line.

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